

Application No. 09/477,637

Claims 1-3 and 14-17 were rejected under 35 U.S.C. Section 102(e) as anticipated by U.S. Patent No. 6,158,882 to Bischoff. In giving the rejection, the examiner alleges that Bischoff discloses substantially all of the elements set forth in independent claims 1 and 14.

Applicant's respectfully traverse this rejection.

The present invention is directed to a flexible, high density, low profile lighting system which includes a flexible printed circuit board substrate, adapted to support an electrically interconnect surface mount LED components. A plurality of surface mount light emitting diodes is mounted on the substrate so as to define a conformably bendable lighting array configured for mounting upon surfaces with compound curvature. Each of the surface mount light emitting diodes has a footprint of 5mm^2 , or less, and when mounted adjacent and in proximity with one another, defines a light intensity output of from about two to about 20 candles per cm^2 , with a uniformity of light output heretofore unrealized in the art.

Thus, as defined in independent claims 1 and 14, the flexible, low profile lighting system comprises a flexible printed circuit board substrate, adapted to support an electrically interconnect surface mount electronic components. Further, the flexible, low profile lighting system comprises a plurality of surface mount light emitting diodes, surface mounted on the flexible printed circuit board substrate. Independent claim 1 has been amended to further recite that the printed circuit board substrate is flexible through at least two axes of rotation, so as to define a conformably bendable lighting array configured for mounting upon surfaces with compound curvature. Independent claim 14 has been amended to further recite that the plurality of surface mount lighting emitting diodes define a light intensity of at least 2,000 millicandles per square centimeter.

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The art of record is not understood to disclose or suggest any of the foregoing, and is particularly not understood to disclose or suggest a plurality of surface mount light emitting diodes mounted on a flexible substrate which is bendable through at least two axes of rotation, or defining an array having a light intensity of at least 2,000 millicandles per square centimeter.

In particular, Bischoff is directed primarily to a dimming apparatus used in conjunction with a conventional LED lighting strip. Bischoff does not disclose or suggest a flexible substrate, adapted to support an electrically interconnect surface mount electronic components and flexible through at least two axes of rotation. Bischoff further does not disclose or suggest a conformably bendable lighting array configured for mounting upon surfaces with compound curvature, as required by independent claim 1.

Further, Bischoff discloses LED lighting strips with the light emitting elements spaced-apart by at least the width of an additional element. Being so disposed, the Bischoff light strip is perceived to emit light from discrete points (hot spots). Indeed, as described in column 4, lines 1-4 of the Bischoff specification, the main purpose of the light tube 12 envelope 14 is to defuse the light emitted by the light emitting diodes 40 to give a smooth wash of light.

In contrast, the present invention disposes surface mount light emitting diodes on a flexible printed circuit board substrate into an array which defines a uniform light intensity of at least 2,000 millicandles per square centimeter. This uniformity and intensity are not disclosed or suggested by Bischoff, nor are they realizable with the spaced-apart Bischoff structure. Bischoff's spaced-apart light emitting diodes are interspersed with current limiting resistors that preclude the Bischoff apparatus from achieving the light intensity and uniformity of the present invention.

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Claims 2 and 3, and 15-17 depend from independent claims 1 and 14, respectively, and partake of the novelty thereof. Accordingly, Applicants request reconsideration and withdrawal of the rejection of claims 1-3 and 14-17 under 35 U.S.C. Section 102(e) as anticipated by Bischoff.

Claims 4-13 and 18, 19 were rejected under 35 U.S.C. Section 103(a) for obviousness over Bischoff in view of U.S. Patent No. 4,298,869 to Okuno and further in view of U.S. Patent No. 6,161,941 to Tait et al.

Applicants respectfully traverse this rejection.

Claims 4-13 and 18, 19 depend from independent claims 1 and 14, respectively, and partake of their novelty. Applicants submit that in connection with the remarks as set forth in connection with independent claims 1 and 14, above, claims 4-13 and 18, 19 are patentable for that reason alone.

Further, neither Bischoff, Okuno or Tait et al. discloses a lighting array comprising light emitting diodes having length and width dimensions no greater than about 3mm and 2mm, respectively. Nor do any of the aforementioned references disclose or suggest a lighting array comprising diodes having length and width dimensions no greater than about 2mm and 1.5mm, respectively. ^{*}Further, none of the aforementioned references disclose or suggest an array of surface mount light emitting diodes which are surface mounted on a flexible printed circuit board substrate so as to contact at least one adjacent surface mount light emitting diode. Certainly, none of the above-noted references discloses or suggests the claimed combinations of component arrangements so disposed to provide a uniform light intensity of at least 2,000 millicandles per square centimeter.

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The examiner apparently relies upon Tait et al. to remedy this particular deficiency. However, Tait et al. cannot be seen as generating a uniform light intensity of at least 2,000 millicandles per square centimeter. Specifically, Tait et al. is directed to an apparatus that focuses the output of an LED array in order to achieve a specified light intensity. Tait et al. cannot be understood as disclosing or suggesting an array which defines a uniform light intensity of at least 2,000 millicandles per square centimeter.

Regarding the examiner's comments as to the dimensionality of the array being a matter of design choice, applicants would remind the examiner that some basis for this assertion is necessary. There is no disclosure or suggestion in the prior art references of an array of light emitting diodes having the structure, arrangement and light output characteristics of the present invention, nor is there a suggestion that the characteristic features of the present invention can be achieved by rearranging the elements of any of the prior art apparatus. If it were merely a matter of design choice, the characteristics and features of the present invention would have been disclosed or suggested in the prior art. Since they were not, any unsupported assertions to the contrary can only be made after having recourse to the claims of the present invention, and thus constitute impermissible hindsight.

For the foregoing reasons, applicants respectfully assert that claims 4-13 and 18,19 contain patentable subject matter over any permissible combination of Bischoff, Okuno and Tait et al. Applicants accordingly request reconsideration and withdrawal of the rejection of these claims under 35 U.S.C. Section 103.

Claims 20-23 were rejected under 35 U.S.C. Section 103(a) for obviousness over Bischoff in view of Tait et al. and further in view of U.S. Patent No. 5,865,529 to Yan.

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In giving the rejection, the examiner asserts that Bischoff discloses a lighting system containing all the limitations of the claims except for the array's light intensity and viewing angle. Tait et al. and Yan, respectively, are relied upon to remedy this deficiency in the Bischoff reference.

Applicants respectfully traverse this rejection.

With regard to independent claim 20, Bischoff is not understood to disclose or suggest the width dimensionality (5mm) feature of the flexible, low profile lighting system of the invention. Nor is Bischoff understood to disclose or suggest a plurality of diodes disposed on such a flexible printed circuit board so as to emit a uniform light intensity of from about 2,000 to about 20,000 millicandles per square centimeter. As discussed above, the Bischoff apparatus comprises spaced-apart LED components which are neither capable of emitting light with the requisite intensity nor emitting light with a requisite uniformity.

Neither Tait et al. nor Yan is understood to disclose or suggest anything that would remedy the deficiencies of Bischoff in this regard. As discussed above, the Tait et al. apparatus is only able to achieve an intensity of 3,500 millicandles per square centimeter by focusing the output of a multiplicity of LEDs. Where the light output is uniform it is not of the requisite intensity. Where the light output is of the requisite intensity, it is not uniform.

Yan is relied upon as disclosing an LED having a viewing angle of at least 120 degrees. However, Yan does not disclose or suggest an LED having such a viewing angle combined into a plurality so as to emit light having an intensity of from about 2,000 to about 20,000 millicandles per square centimeter. Indeed, Yan teaches diffusing the light from each individual diode so as to make the diode visible over a wide viewing angle. Tait et al., on the other hand, teaches

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focusing the light output of narrow beam LEDs in order to achieve a localized region of high light intensity. Combining Yan with Tait et al. would obviate the stated purpose of either.

For these reasons, applicants respectfully submit that claims 20-23 are patentable over any permissible combination of Bischoff, Tait et al. and Yan, and respectfully request reconsideration and withdrawal of the rejection of these claims under 35 U.S.C. Section 103 for obviousness.

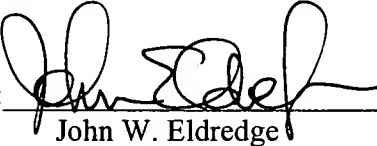
Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Applicants submit that claims 1-23, and the application as a whole, are in condition for allowance. Notification of same and early passage to issue are respectfully solicited.

Please address all correspondence to **STRADLING YOCCA CARLSON & RAUTH, IP Department, 660 Newport Center Drive, Suite 1600, P.O. Box 7680, Newport Beach, California 92660-6441.**

Respectfully submitted,

STRADLING YOCCA CARLSON & RAUTH

By: 
John W. Eldredge
Reg. No. 37,613
(949) 725-4143

JWE/dlb

STRADLING YOCCA CARLSON & RAUTH
IP Department
660 Newport Center Drive, Suite 1600
P. O. Box 7680
Newport Beach, CA 92660
Telephone: (949) 737-4703
Facsimile: (949) 725-4100

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please amend claims 1, 14 and 20 as follows:

1. A flexible, low profile lighting system, comprising:
a flexible printed circuit board substrate, the substrate adapted to support and electrically interconnect surface mount electronic components, the printed circuit board substrate flexible through at least two axes of rotation;
a plurality of surface mount light emitting diodes; and
wherein the plurality of light emitting diodes are surface mounted on the flexible printed circuit board substrate, so as to define a conformably bendable lighting array configured for mounting upon surfaces with compound curvature substrate, the array outputting a uniform light intensity of at least 2000 millicandles per square centimeter.
14. A flexible, low profile lighting system, comprising:
a flexible printed circuit board substrate, the substrate adapted to support and electrically interconnect surface mount electronic components;
a plurality of surface mount light emitting diodes, wherein the plurality of light emitting diodes are surface mounted on the flexible printed circuit board substrate, the array outputting a uniform light intensity of at least 2000 millicandles per square centimeter; and
a flexible housing enclosing the flexible printed circuit board substrate and the plurality of surface mount light emitting diodes.
20. A flexible, low profile lighting system, comprising:
a flexible printed circuit board substrate, having a first end, a second end, and an axis extending between the first and second end, the flexible printed circuit board substrate further including a width dimension measured in a direction transverse to the axis that is less than 5mm; and
a plurality of surface mount light emitting diodes, disposed on the flexible printed circuit board substrate such that the plurality of diodes emits a uniform light intensity of from about 2000 to about 20,000 millicandles per square centimeter.

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